Semiconducting and magnetic properties of La0.67Ca0.33Mn 1-xDyx O3 ceramics

ABSTRACT

Electrical resistivity measurements of La0.67Ca0.33Mn1-xDyxO3, x = 0.00 to 0.12, ceramics have been studied using a standard four point probe technique, while the magnetic behaviour have been studied using Ac susceptibility technique. The transport properties show the transition of semiconducting to metallic conductivity at TP and Paramagnetic-Ferromagnetic transitions, TC, were observed in the χ-temperature curves for all samples. The existence of metallic conductivity, TP, and ferromagnetism, TC, were found to be linearly correlated. This phenomenon of coexistence are due to the double exchange interaction of two electrons in Mn3+-O2--Mn4+ and Mn4+-O2--Mn3+ configuration which brings the system below Tc into a metallic state. Hence it is observed that the Curie temperature Tc is closely related to the sharp decrease in the electrical resistivity of the samples. However, both transition temperatures shift to lower temperature as dysprosium doping increases indicating the loss of ferromagnetic order and transport properties. As for the transport properties the semiconductor model ln(σ) to approximately (Eg/2kT) was used to explain the conduction mechanism of perovskite manganites above Tp. It was concluded that the total conductivity, σtot, consists of the intrinsic and the extrinsic components, such that σtot = σint+σext. The energy gap decreases initially from 0.11 eV to a minimum value of 0.06 eV at x = 0.03 and increases again to 0.08 eV at the composition of x = 0.12 for extrinsic region.

Keyword: Ceramic; Semiconducting; Magnetic behaviour; Transport properties